

Repository-Based Software Engineering Program

Working Program Management Plan

Applied Expertise, Inc.

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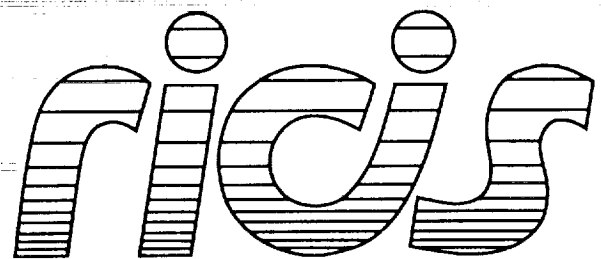
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WORKING PROGRAM MANAGEMENT PLAN
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*Research Institute for Computing and Information Systems
University of Houston-Clear Lake*

RICIS Preface

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The views and conclusions contained in this report are those of the author and should not be interpreted as representative of the official policies, either express or implied, of UHCL, RICIS, NASA or the United States Government.

University of Houston - Clear Lake
Repository-based Software Engineering Program

WORKING PROGRAM MANAGEMENT PLAN

APRIL 15, 1993

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**REPOSITORY-BASED SOFTWARE ENGINEERING PROGRAM
PROGRAM MANAGEMENT PLAN**

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REPOSITORY-BASED SOFTWARE ENGINEERING PROGRAM PROGRAM MANAGEMENT PLAN

1.0 INTRODUCTION

This section of the Program Management Plan (PMP) for the Repository-based Software Engineering Program (RBSE) provides a summary description of the program, defines the purpose of the PMP and specifies the scope and methodology used to prepare the PMP.

1.1 Program Summary Description

RBSE is a National Aeronautics and Space Administration (NASA) sponsored program dedicated to introducing and supporting common, effective approaches to software engineering practices. The process of conceiving, designing, building and maintaining software systems by using existing software assets that are stored in a specialized operational reuse library or repository, accessible to system designers, is the foundation of the program. In addition to operating a software repository, RBSE promotes (i) software engineering technology transfer, (ii) academic and instructional support of reuse programs, (iii) the use of common software engineering standards and practices, (iv) software reuse technology research, and (v) interoperability between reuse libraries.

1.2 PMP Purpose

This Program Management Plan (PMP) is intended to communicate program goals and objectives, describe major work areas, and define a management report and control process. This process will assist the Program Manager, University of Houston at Clear Lake (UHCL) in tracking work progress and describing major program activities to NASA management. The goal of this PMP is to make managing the RBSE program a relatively easy process that improves the work of all team members. Any part of the PMP that detracts from that goal, or is extraneous to it, should be changed. Therefore, this PMP is not intended to be static, but rather a living document, responsive to changes in the program and changes in the need for various management processes and tools.

1.3 PMP Scope

The PMP describes work areas addressed and work efforts being accomplished by the program; however, it is not intended as a complete description of the program (See Appendix A for a list of related RBSE program documents). Its focus is on providing management tools and management processes for monitoring, evaluating, and administering the program; and it includes schedules for charting milestones and deliveries of program products. The PMP was developed by soliciting and obtaining guidance from appropriate program participants, analyzing program management guidance, and reviewing related program management documents.

2.0 ORGANIZATIONAL STRUCTURE

This section provides a brief description of the roles and responsibilities of those organizations responsible for assuring that the RBSE program successfully achieves its goals and objectives in the most effective and efficient manner practical. The management structure is diagrammed below (figure 2.1).

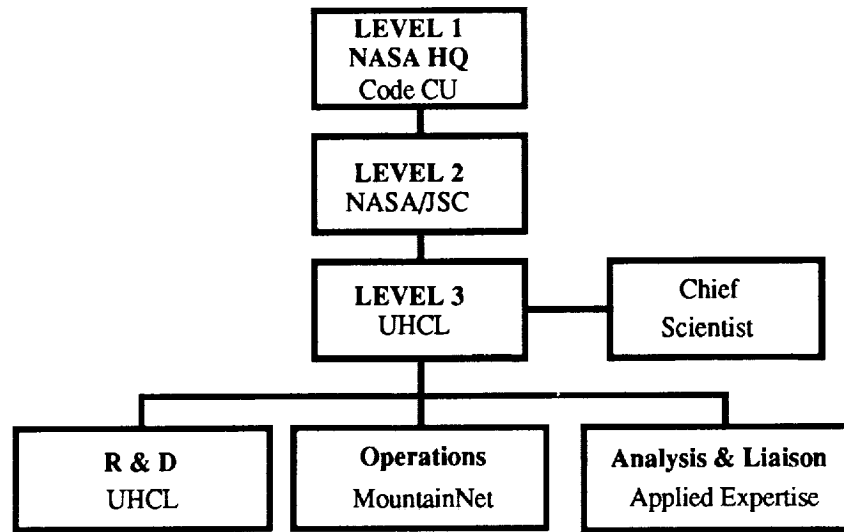


Figure 2.1: Management Structure

2.1 National Aeronautics and Space Administration (NASA)

The Level One manager at NASA headquarters is responsible for providing general oversight and advocacy of the RBSE program. The manager provides guidance on budget and congressional issues. The Level One manager is a liaison with other sponsoring and cooperative agencies and organizations, acts as an advocate for RBSE with Federal R&D programs and works to integrate RBSE with the NASA-wide Technology Transfer Network.

2.2 Johnson Space Center (JSC)

The Level Two manager at JSC provides technical oversight of the program and evaluates the program for the Level One manager. The manager is also an advocate for RBSE within JSC and the contractor community. The Level Two manager promotes the utilization of RBSE's resources and reports directly to the Level One manager.

2.3 University of Houston at Clear Lake (UHCL)

The Research Institute for Computing & Information Systems (RICIS) is part of UHCL. The RICIS Program Manager for RBSE is the Level Three manager. The Program Manager is responsible for providing program-wide planning and management; generating and analyzing schedules and budgets; and tracking the status of various project activities for the Level Two manager. The Program Manager also documents program plans and communicates them to RBSE participants. The Program Manager is directly responsible to the Level Two manager at JSC.

2.4 UHCL Research and Development

The research element of RBSE is responsible for conducting original research into advanced software engineering techniques, including reuse and the life cycle process model. It provides a liaison with academic and other research activities and promotes activities beneficial to the RBSE program. Research also develops pilot projects which demonstrate the reuse concept and the services available through the repository. Finally, Research supports the ASV3 system, adding features and fixing bugs in the system. Research reports directly to the RBSE Program Manager.

2.5 MountainNet, Inc.

MountainNet, Inc. is responsible for the operation of the AdaNET repository. This includes maintaining the repository's hardware and software system and the electronic and hardcopy information stored in the repository or cataloged in the library. It identifies and acquires new components and archives obsolete components. It provides technical support to the customers of the repository, promotes the RBSE repository to new users, and participates in software engineering conferences and other public relations events. It also promotes interoperability with other reuse libraries (through participation in the Reuse Library Interoperability Group) and encourages education about reuse in schools and universities. MountainNet reports directly to the RBSE Program Manager at UHCL.

2.6 Applied Expertise, Inc. (AE).

AE provides management analysis, liaison and coordination support to the RBSE Program Manager. It also maintains liaison with related NASA, government and industry software engineering programs and reports on their activities. As part of this, AE provides input to the Reuse Library Interoperability Group Technical Committee and attends various academic and industry meetings and conferences. In addition, AE provides analysis and support for the Level One and Level Two NASA managers.

3.0 PROGRAM GOALS

This section provides a summary description of the goals of RBSE and highlights the nature of activities conducted. Specific quantifiable objectives are not discussed in this section; rather, a process for developing them is outlined in section 5.5.

3.1 Summary Description of Goals

RBSE is a research and development program that will upgrade and evolve a reusable software component repository called AdaNET. Currently, the repository contains only public domain components; there are plans to also incorporate components with more limited distributions (e.g. NASA-use only). RBSE's ongoing and long term goal is to improve the quality of software-intensive systems developed by NASA and other RBSE customers and to increase RBSE's responsiveness to those customers' demands for products and services that support software reuse. To accomplish this goal, RBSE conducts research into advanced software reuse technology, operates and maintains a software repository in West Virginia, promotes software engineering technology transfer within NASA, champions reuse through repository-based software engineering by actively participating in academic and other professional organizations, and promotes interoperability with other reuse libraries.

3.2 Researching Software Technology

RBSE research works to improve the functioning of the AdaNET repository and keep it a state of the art facility. RBSE research develops pilot projects to gather information about RBSE's implementation of reuse in the real world and to expand RBSE's customer base. The pilots also develop information about customer software needs and improve the responsiveness of the repository to those needs. In the long term, RBSE research activities aim to evolve the theory and practice of software engineering reuse technology to help remove barriers to the implementation of reuse and expand its use by professional software engineers.

3.3 Operating a Viable, Self-sustaining Software Repository

RBSE expects to develop and operate a software component reuse repository with a sufficient customer base to enable the repository to sustain its operations. RBSE's goal is to have a useful, easy to use repository dedicated to satisfying high value needs of its customers. This includes developing legal and security procedures that fit its client's needs.

3.4 Promoting Software Technology within NASA

Through its research and repository operations, RBSE expects to promote reuse of NASA-only software components and increase the overall quality of software engineering for its NASA customers.

3.5 Advancing Education and Awareness about Repository-based Software Engineering

To help advance the concept of reuse as a standard practice for software engineers to consider, RBSE works to educate today's software engineering students. This is accomplished by introducing reuse concepts into the classroom today with the anticipation of generating a pool of software engineers tomorrow who will consider reuse an integral part of software engineering. In addition to educating students, RBSE also tries to advance awareness of the program among current software professionals by attending conferences and symposia, attending meetings of relevant professional groups, and by publishing papers which describe program activities.

3.6 Promoting Interoperability

RBSE works to help promote interoperability among reuse libraries. Interoperability is defined as the ability of a reuse library to exchange assets, asset descriptions, and other information with other libraries. By working to establish interoperability among reuse libraries, RBSE helps to promote reuse, expands the collection of software components available to its customers, and enlarges its customer base.

4.0 MAJOR WORK AREAS

This section describes the major work activities underway or planned for calendar year 1993. The work areas are arranged by work activity and describe the nature of the activity and its objective. Each of the organizations described in Section 2.0 have a role in assuring that these activities are successful. These roles include responsibility for performing, reviewing and coordinating the work and its results.

4.1 Space Transportation Systems (Shuttle) Operations Contract Pilot Program

This is a series of pilot projects that seeks to upgrade 10 million lines of simulation software. First, the preliminary pilot seeks to prove the feasibility of converting unstructured FORTRAN code to object-oriented software. If the preliminary pilot is successful, the second stage will be an expanded pilot upgrading additional lines of code. Success here will lead to the upgrade of the full 10 million lines of code. Throughout this pilot project, RBSE Research will support the training of programmers in Object Oriented Design, collect and catalog reusable software components and related information, promote the use of the assets within the pilot and train and support the pilot staff in making use of RBSE's reuse library. Any of the assets collected for use within the pilot that are appropriate for distribution outside of the pilot will be the responsibility of the operations team. RBSE will also gather information on how to tailor its products for a specific NASA customer.

4.2 Operating the AdaNET Repository

MountainNet, Inc. is responsible for the operation of the AdaNET repository. The specific activities of this major work area include client services, repository maintenance, sustaining engineering and operations management. A brief description of each of these activities follows:

4.2.1 Client Services - this part of the repository operation seeks to serve the users beyond the services available on-line. This includes operating the help desk and the technical referral service, responding to requests for information on RBSE and distributing software components by mail. Client Services also seeks new users through promotion and outreach programs. It works with local high schools, West Virginia University, and University of Houston - Clear Lake to educate the next generation of software engineers about reuse. Client Services also is responsible for sending out newsletters and press releases about RBSE, giving product briefings to interested groups and attending conferences.

4.2.2 Repository Maintenance - this part of the repository operation maintains all of the information, both electronic and hardcopy, involved in the repository. It includes identifying sources for assets and obtaining new assets. The objects obtained are evaluated and classified before being added to the repository. Obsolete objects are archived.

4.2.3 Sustaining Engineering - this part of the repository operation maintains the system hardware and software. This includes monitoring the performance of the system for mechanical breakdown, software problems, and security violations. Sustaining Engineering is also responsible for daily backup of the system.

4.2.4 Operations Management - this part of the repository operation plans and coordinates the activities of Client Services, Repository Management and Sustaining Engineering, and also coordinates Operations with Liaison and Research. It also administers the contract, prepares budgets, and makes financial reports to the appropriate parties. Operations management collects statistics from all parts of operations and generates reports on the repository's activities. It also coordinates the outreach activities of the repository and the marketing of the repository and its services.

4.3 Establishing a NASA-only Library

MountainNet would have the lead in setting up a NASA-only library within the AdaNET Repository. Initial efforts will be focused on establishing the process for security and distribution of NASA-only assets. The next step will be to populate the NASA-only library with assets such as the contents of the NASA JSC Software Technology Branch Library.

4.4 Reuse and Repository Promotion, Coordination and Liaison Activities

All organizations associated with RBSE are dedicated to promoting reuse as an advanced software engineering development concept, coordinating activities with other libraries and professional organizations, and maintaining liaison with other involved groups. These activities allow RBSE to define and establish working relationships with potential customers, coordinate its activities with those of other reuse libraries and professional groups, gather management and technical information from other Federal and commercial reuse initiatives, and expand RBSE's customer and supplier base. A brief description of some of these efforts are as follows:

4.4.1 The Strategic Avionics Technology Working Group (SATWG) - SATWG is a NASA-wide group that coordinates research and development in avionics and promotes dialogue between the users and suppliers of NASA strategic avionics technology, including

government, industry and academia. RBSE will ascertain whether it will have a role in (i) managing SATWG documents, (ii) providing an electronic bulletin board and message service to SATWG members, (iii) promoting reuse among SATWG's members, (iv) offering use of RBSE's repository, and (v) learning more about the software needs of SATWG's members.

4.4.2 Software Technology Working Group (STWG) - STWG is an effort led by the Jet Propulsion Laboratory and Langley Research Center to coordinate software technology research efforts NASA-wide and thereby increase the technology transfer impact of those activities. RBSE is a founding member of the STWG. RBSE work activities include determining whether it should become a vehicle for promoting STWG's products.

4.4.3 Interoperability - RBSE works with several organizations to promote interoperability among reuse libraries through the standardization of appropriate software component classifications, communications, transfer protocols and related mechanisms and interoperation policies. Its most prominent role is as a leading member of the Reuse Library Interoperability Group (RIG). The RIG's members represent a diversity of government and industry software engineering reuse libraries. The RIG provides for discussion and exchange of new reuse initiatives and technology advancements between reuse libraries such as ASSET and CARDS.

4.4.4 Liaison - Liaison activities take place within and outside of NASA. Within NASA these activities include maintaining and propagating communications with related NASA programs in order to sustain a unique niche for RBSE, promoting reuse of NASA software components and repository based software engineering in general, increasing program support and identifying opportunities for cooperation. Outside of NASA, liaison activities include maintaining and propagating communications with related government and industry programs in order to leverage research and operations investments, obtaining software components for reuse by NASA (and other RBSE customers, as appropriate), and identifying opportunities for cooperation and collaboration.

5.0 PROGRAM MANAGEMENT, CONTROL AND OVERSIGHT

RBSE, like most complex endeavors requiring input and activity by a number of different organizations at different locations, requires extensive coordination and communication. Accordingly, this section describes the management processes and tools required by the Project Manager at UHCL to assure that RBSE successfully makes progress toward achieving its stated goals and objectives in the most effective and efficient manner practical. The RBSE program management should be a participatory process, reflecting a consensus of the management requirements of the RBSE team members and the Program Manager. Therefore, the management controls and processes, reports and meetings, and goals and measurements discussed in this section were developed by soliciting and obtaining guidance from all RBSE team members.

The meetings and reports specified as part of the management process (not including the financial reports discussed in section 5.3) and each meeting or report's purpose is summarized in figure 5.1 below.

Activity	Date Due	Comments
1. <u>Impromptu Meetings</u> Meetings called by any RBSE team member with any other RBSE team member.	As needed	These are ad hoc meetings to discuss activities, issues or ideas with other team members. When appropriate, the results of these ad hoc meetings should be transmitted to RBSE team members not in attendance.
2. <u>Configuration Control Board Meeting</u> Teleconference between Program Manager, Research, MountainNet Inc., and the software developers at JSC.	Weekly	This meeting focuses on the repository's software system, problems with the system and other software issues.
3. <u>Monthly Management Report</u> Monthly management reports are required from each RBSE team member and forwarded to the Program Manager.	20th day of the month	These are prescribed management reports highlighting the work accomplished during the period, the work to be undertaken during the next period, and problems encountered. The report also includes a number of exhibits.
4. <u>Monthly Team Meeting</u> Attended by all RBSE team members to discuss the month's activities.	As arranged by Program Manager	These are action oriented working sessions directed at solving program problems and are loosely based on the MMRs. Action items are captured in writing and RBSE team members are given tasks to address various issues.
5. <u>Quarterly Team Meeting</u> Attended by all RBSE team members to discuss long term program activities.	Concurrent with every third monthly meeting	The meetings are oriented toward strategic planning, goals and the definition of goals, and evaluations of program activity.
6. <u>Consolidated Management Report (CMR)</u> Report to the Program Manager for approval and transmission to the NASA level 2 program manager.	No later than 10 working days after quarterly meeting	This report is a summary of the program's activities. It provides the Program Manager and the level 2 manager with an overview of program activities and progress and consolidates statistical information on the program.
7. <u>Annual Report</u> Report to the Program Manager for approval and transmission to the NASA level 2 program manager.	No later than 20 working days after the end of the fiscal year	This report replaces the fourth quarter CMR. It includes the information from the CMR and adds a broad overview of the program activities for the year.

Figure 5.1: Summary of Meetings and Reports

5.1 Management Reports

Management reports provide the RBSE Program Manager at UHCL with the information necessary to evaluate program progress, measure accomplishments against stated goals, identify and resolve problems, and assure that program accomplishments and status are commensurate with financial budgets and expenditures. The PMP requires three types of management reports as described in the following sections. In addition, the Level One, Two, or Three Managers may request additional specialized reports as they see fit.

5.1.1 Monthly Management Reports (MMR) - The MMRs are required to be submitted to the RBSE Project Manager at UHCL by the 20th day of each month covering the previous month's activities. The MMRs are intended to be flexible but must provide the Project Manager with sufficient qualitative and quantitative information to allow him/her to (i) take appropriate management actions when necessary, (ii) address reported problems when required, and (iii) provide NASA with program assessments when questioned. Each RBSE team member (Applied Expertise, UHCL Research and MountainNet, Inc.) is to prepare their own MMR. These reports should be concise and limited to five pages or less, not including exhibits. The following report sections and schedules are proposed.

Highlight Section - This section of the MMR should emphasize the most important aspects of the month's activities. It should highlight the work accomplished that month, work planned next month, and issues requiring management attention.

Work Area Activity Section - This section of the report will provide detailed information on work accomplished during the reporting period.

Status of Reported Issues - This should be an exhibit attached to the report reflecting pertinent information about issues raised during the current reporting period and the status of issues raised during prior reporting periods. These issues may be specific to the RBSE team member or apply to the program as a whole. (See Exhibit 5.1.1 A for proposed format)

Schedule of Progress Toward Goals - This should be an exhibit attached to the report reflecting cumulative progress to date and progress during the reporting period toward achieving objectives and goals. Each team member will be responsible for preparing their own objectives in accordance with the overall RBSE program goals. (See Exhibit 5.1.1 B for proposed format. See Section 5.5 for an explanation of goals and measurements.)

Schedule of Milestones Achieved - Not all activities undertaken by the RBSE program are easily quantifiable. Those that aren't may be better reported as the completion of a series of milestones than measured numerically. This form should be an exhibit attached to the report that will show what milestones in achieving an objective have been completed in a given month in comparison to planned completion dates. Each team member will be responsible for preparing their own objectives and milestones in accordance with the overall RBSE program goals. (See Exhibit 5.1.1 C for proposed format. See Section 5.5 for an explanation of goals and measurements.)

Staff Availability and Use - This should be an exhibit attached to the report reflecting major work areas, staff availability, and staff use. The

purpose of this schedule is to provide the Program Manager with a view of the distribution of staff hours expended by activity. It also shows the relationship between the number of hours expended for an activity, the number of hours budgeted, and work accomplished. (See Exhibit 5.1.1 D for proposed format)

Change Request (CR)/Discrepancy Report (DR) Status Report - This report appraises the Program Manager of the status of all CRs and DRs. It should include a description of the change or discrepancy, when it was reported, and what action has been taken. This report will be supplied to the Program Manager monthly by UHCL Research as part of the new configuration management system being developed.

5.1.2 Consolidated Management Report (CMR) - The CMR is a quarterly report consolidating information provided to the Program Manager in the MMR by the different RBSE Team Members. The report is intended to provide the Program Manager and the level 2 NASA manager with an overview of program activities and progress and a consolidation of the status of reported issues and other pertinent statistical information. The report will be prepared by Applied Expertise, Inc. and forwarded to the Program Manager no later than 10 working days following the quarterly RBSE Team meetings.

5.1.3 Annual Report - The Annual Report is a yearly report, consolidating the past year's monthly reports and CMRs. It replaces the fourth quarter CMR and includes the information that would have been contained in the fourth quarter CMR. The Annual Report is intended to provide the Program Manager and the level 2 NASA manager a broad overview of program activities for the past year. It should focus on the major accomplishments of the program for the past year, any major issues that remain unresolved, and opportunities for the growth of the program over the next year. It should also discuss the progress made over the past year toward meeting the program's goals and objectives. The report will be prepared by Applied Expertise, Inc. and forwarded to the Program Manager no later than 20 working days following the end of the fiscal year.

5.1.4 Other Reports - These are specialized reports requested from any of the RBSE team members by the Level One, Two, or Three managers on an ad hoc basis. Examples of these reports could be a briefing for senior NASA management or a report to Congress.

5.2 Financial Reports

Financial reports, in tandem with management reports, provide the Program Manager with a consolidated overview of how well the RBSE program is doing. Financial reports are generated by each team member and sent to the RICIS Financial Specialist at UHCL. Summary financial reports are generated by the RICIS and provided to the Program Manager. The PMP requires a number of different financial reports as described in the following sections.

5.2.1 Monthly Contractor Cost Performance Report - This report is currently prepared by each RBSE Team Member and sent to the RICIS Financial Specialist by the 20th day of each month. It reflects the current months cost and estimates cost over the next two months. (See Exhibit 5.2.1 A for proposed format)

5.2.2 Monthly RBSE Budget Projections - This is a monthly report prepared by the RICIS Financial Specialist for the Program Manager. The report provides an overview of actual and estimated costs for the fiscal year by cost category. To enhance financial oversight and provide the Program Manager with more detailed information on financial status, a modified reporting format is suggested. (See Exhibit 5.2.2 A for proposed format)

5.3 Meetings

Each member of the RBSE team is encouraged to participate in face-to-face or telephonic meetings with other team members. These meetings provide opportunities to clarify misunderstandings, explore new ideas, propose innovations and enhance the participatory management style favored by the Program Manager.

5.3.1 Impromptu - Face-to-face or telephonic impromptu meetings between team members are encouraged. Impromptu meetings can be called by any team member with any other team member on an ad hoc basis. The purposes of the meetings vary but can include discussing on-going operations, new ideas and approaches, potential markets and clients, etc. Any actions resulting from the meetings which requires significant staff time, or alter program management or direction must be approved by the Program Manager before implementation. (See Section 5.4 Approval of Program Changes) Impromptu meetings need not be documented unless deemed appropriate by the meeting participants.

5.3.2 CCB - Configuration Control Board meetings are held weekly or as needed by those RBSE team members involved in the software development process. The meetings are generally held by teleconference to discuss discrepancies and other matters relating to the repository's software system. The results of these meetings should be reported in the MMR.

5.3.3 Monthly - These scheduled meetings are intended to be action oriented working sessions directed at resolving program problems. The preceding month's MMR should provide the substructure for the meeting. The meetings are generally held near the end of the month at a location decided upon by the Program Manager. Applied Expertise, at the direction of the Program Manager and in coordination with other RBSE team members, will prepare and distribute an advanced agenda for the meetings to all RBSE team members and the Program Manager. The agenda for each meeting should be clear and well defined; RBSE team members should make sure that all the items that they want discussed at the meeting are included in the written agenda prior to the meeting. Action items resulting from the meetings will be captured in writing and followed up until resolved. Progress on action items will be reported in the next month's MMR.

5.3.4 Quarterly - These scheduled meetings are intended to be oriented more toward strategic planning, assessments of progress towards goals, and evaluations of program activity. They are held concurrently with every third monthly meeting. The timing, location and preparation for the meetings are arranged in the same manner as the monthly meetings. That quarter's CMR (discussed above) is due 10 working days after the quarterly meeting.

5.3.5 Conferences and Seminars - It is imperative that RBSE team members stay abreast of technology advancements in software reuse and keep current with the activities of other reuse libraries and professional software engineering organizations. To this end, RBSE team members are encouraged to take leadership roles in relevant professional organizations and attend those conferences and seminars which would benefit the RBSE program and the program activities of one or more of its team members. Each team member should attend "worthwhile" conferences and seminars held locally. Seminars and conferences requiring per diem travel should be coordinated with other team members and approved by the Program Manager. Team members attending a seminar or conference should prepare a written synopsis highlighting matters of significance to the RBSE program. The synopsis should be transmitted to the Program Manager and other RBSE team members. A brief list of conferences and meetings attended should appear in each month's MMR.

5.4 Approval of Program Changes

The program activities of each RBSE team member should not be static. As the program evolves, team members may wish to take on major new projects or to eliminate current activities that are not substantially forwarding major program goals. These program changes must be coordinated among team members and approved by the Program Manager. The management process for obtaining approval of program deletions and changes is described in the following subsections.

5.4.1 Formal Program Additions and Deletions - All program deletions and major program additions must be approved by the Program Manager. The RBSE team member wishing to make a substantial change in its program activities must submit a complete description of the change to the Program Manager, fully justifying the change in terms of its cost, potential benefits, and its compatibility and relationship to the long term program goals. These changes must also be discussed with other RBSE team members who would be affected.

5.4.2 Informal Program Additions - While any major program additions requiring a substantial use of RBSE's resources must be approved by the Program Manager, each RBSE team member should be free to take on limited additional projects as they see fit. These informal additions allow each RBSE team member to pursue development projects on their own initiative, without having to gain approval of the Program Manager. For example, these projects could include setting up a limited trial use of the repository by a potential user or setting up a series of meetings with an industry group interested in reuse. If an additional project proves fruitful in any way, it should be brought to the attention of the Program Manager and other RBSE team members. If the additional project proves successful enough that it could become a major program activity, or require substantial resources, it should be submitted to the Program Manager as a formal program addition.

5.4.3 Changes to the Repository - The AdaNET repository cannot and should not be static, components contained in the library should be evaluated for activity and usefulness to active and potential clients. Components in the library with limited use should be expunged and new components added. All RBSE team members should work together to produce a coherent acquisition plan for the repository, evaluating it in terms of RBSE's current clients and the new focus on serving NASA clients. The acquisition plan should lay out current and potential sources of components, and detail the types of components viewed as priorities for inclusion in the repository. The plan should also identify potential new clients and the types of components necessary to serve their needs.

5.5 Setting Goals and Measuring Performance

The purpose of this section of the PMP is to define the management process for identifying and recording program objectives that relate to the established goals articulated in Section 3.0 of the PMP. The measurement indicators (metrics) for each of the objectives accepted and approved by the Program Manager must be established by the RBSE team members. The PMP reiterates the program goals articulated in the Concept Document and the RBSE White Paper dated February 9, 1993, but is not intended to impose specific objectives or measurements for achieving these goals. This later step which is the essence of measuring progress toward goals must be established by the individual RBSE team members, accepted by a consensus of the team members, and approved by the Program Manager.

The specific objectives relating to program goals; the activities and actions required of each team member to achieve these objectives; and the measurements to evaluate progress toward achieving these objectives should be in place no later than the end of fiscal year 1993. (September 30, 1993)

5.5.1 RBSE Goals - As described in section 3.0, the PMP and its predecessor documents have identified five broad goals for the RBSE program. They are:

- (i) researching software technology to enhance reuse and improve repository operations,
- (ii) operating a viable, self-sustaining software repository,
- (iii) promoting software technology transfer within NASA,
- (iv) advancing education and awareness about repository-based software engineering and,
- (v) promoting interoperability between software repositories.

These goals are difficult to quantify and in some cases, such as researching software technology to enhance reuse and improve repository operations, may not lend themselves to life-of-program targets. Therefore, specific measurable objectives which relate to one or more of the program goals should be developed and used to evaluate progress. (see Section 5.5.2).

5.5.2 Goal Related Objectives and Metrics - Each RBSE team member should develop a series of specific quantifiable objectives that could be measured against a standard or life-of-program target to demonstrate program progress toward one or more of the established goals. That is, the specific objectives should represent discreet, concrete steps towards these goals. Metrics for measuring progress toward achieving the specific objectives should be established on the following criteria:

- (i) The metrics should provide a useful measure of progress;
- (ii) the metrics should be quantifiable for comparison against an established standard or target; and
- (iii) the cost and time to produce the metrics should be commensurate with the benefits obtained by senior managers for evaluating program progress, expansion, retraction or elimination.

5.5.3 The Management Process - The process for setting objectives and measurements must begin as soon as practical. To a great extent, MountainNet has already established a number of areas which can be used to measure progress toward the goal of operating a viable software repository. Also, Research has established a number of objectives which can be used to measure progress toward enhancing reuse and improving repository operations. To institutionalize the process into the program management scheme, the following steps and time frames are proposed:

- (i) Each team member, MountainNet, Research, and AE must complete a series of specific objectives which allow the team member to establish a numerical life-of-program target. The member should then establish measurements which allow management to evaluate progress toward achieving the program target. As stated earlier each of objectives must also be related to one or more program goals.
- (ii) The objectives and associated measurements for evaluating progress should be presented on individual objective sheets during the first quarterly meeting following the approval of the PMP. (See Exhibit 5.5.3 A for illustration)
- (iii) Progress toward the objectives approved for each team member should then be reported monthly as an attachment to the MMR. (See Exhibit 5.1.1 B for suggested format)

STATUS OF REPORTED ISSUES

Track ing #	Prio rity	Date Entered	Issue Raised By	Issue/Risk	Actions	Responsi- bility	Date Resolved
1							
2							
3							
4							
5							
6							
7							
8							

This form is to be completed and included as an exhibit to each team member's Monthly Management Report
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SCHEDULE OF PROGRESS TOWARDS GOALS

A. Researching Software Technology				
---	--	--	--	--

Objective	Life-of-Program Target	Progress this Month	Cumulative Progress to Date	Comments
1.				
2.				
3.				
4.				

B. Operating a Viable, Self-Sufficient Software Repository				
---	--	--	--	--

Objective	Life-of-Program Target	Progress this Month	Cumulative Progress to Date	Comments
1.				
2.				
3.				
4.				

C. Promoting Software Technology Within NASA				
---	--	--	--	--

Objective	Life-of-Program Goal	Progress this Month	Cumulative Progress to Date	Comments
1.				
2.				
3.				
4.				

D. Advancing Education about Repository-based Software Engineering				
---	--	--	--	--

Objective	Life-of-Program Goal	Progress this Month	Cumulative Progress to Date	Comments
1.				
2.				
3.				
4.				

E. Promoting Interoperability				
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Objective	Life-of-Program Target	Progress this Month	Cumulative Progress to Date	Comments
1.				
2.				
3.				
4.				

<p>This form is to be completed and included as an exhibit to each team member's Monthly Management Report. Four objectives have been shown under each goal. This is for the purposes of illustration; as many or as few objectives as are needed may be listed under each goal. Also, objectives may be listed under more than one program goal.</p>

SCHEDULE OF MILESTONES ACHIEVED
--

A. Researching Software Technology			
---	--	--	--

Milestone	Planned Completion Date	Actual Completion Date	Comments
1.			
2.			
3.			

B. Operating a Viable, Self-Sufficient Software Repository			
---	--	--	--

Milestone	Planned Completion Date	Actual Completion Date	Comments
1.			
2.			
3.			

C. Promoting Software Technology Within NASA			
---	--	--	--

Milestone	Planned Completion Date	Actual Completion Date	Comments
1.			
2.			
3.			

D. Advancing Education about Repository-based Software Engineering			
---	--	--	--

Milestone	Planned Completion Date	Actual Completion Date	Comments
1.			
2.			
3.			

E. Promoting Interoperability			
--------------------------------------	--	--	--

Milestone	Planned Completion Date	Actual Completion Date	Comments
1.			
2.			
3.			

This form is to be completed and included as an exhibit to each team member's Monthly Management Report. It is an alternative to the Schedule of Progress Towards Goals and is intended as a reporting form for those program activities that are not easily or usefully quantifiable. Three milestones have been shown under each goal. This is for the purposes of illustration; as many or as few milestones as are needed may be listed under each goal. Also, objectives may be listed under more than one program goal.

STAFF AVAILABILITY AND USE

Description of Service	F/Y Avail	This Period	Expended to Date	Page Ref.	Remarks
<u>Major Service Activity:</u>					
1.					
2.					
3.					
<u>Major Service Activity:</u>					
1.					
2.					
3.					
<u>Major Service Activity:</u>					
1.					
2.					
3.					
<u>Training and Meetings</u>					
<u>Other</u>					

This form is to be completed and included as an exhibit to each team member's Monthly Management Report

MONTHLY CONTRACTOR COST PERFORMANCE REPORT

RA.## - Company Name

To: RICIS Financial Specialist
University of Houston - Clear Lake, Box 384
2700 Bay Area Boulevard
Houston, TX 77058-1098

*Date Submitted_____

From: _____
(Company Name)

1. Research Activity Number _____
Contract Number _____
Latest Approved Modification Number _____
2. For the Month Ending _____
3. Costs For the Month Ending _____
4. (Optional) Invoice Amount Billed and Number _____
5. Cumulative Costs Through the Month Specified in Item 2: _____
6. Estimated Monthly Costs for the First Month Following the Month Specified in Item 2:

7. Estimated Monthly Costs for the Second Month Following the Month Specified in Item 2:

8. Remarks: _____

Signature (Authorized Representative)

*Must be received no later than the 20th of each month. This report may be faxed to (713) 283-3810.

MONTHLY BUDGET PROJECTIONS FOR ALL RBSE FUNDS FOR FYXX

Prepared: mm/dd/yy
 Revised: mm/dd/yy

		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Total
Contract 1	Budget													
	Actual													
	Percent													
Contract 2	Budget													
	Actual													
	Percent													
Contract 3	Budget													
	Actual													
	Percent													
Contract 4	Budget													
	Actual													
	Percent													
Contract 5	Budget													
	Actual													
	Percent													
Contract 6	Budget													
	Actual													
	Percent													
Contract 7	Budget													
	Actual													
	Percent													
TOTAL	Budget													
	Actual													
	Percent													

This report is prepared monthly by the RICIS Financial Specialist and submitted to the Program Manager. The above is shown as an example and is to be filled in with appropriate dates and contract numbers.
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WORKSHEET FOR RELATING OBJECTIVES AND ACTIVITIES TO A PROGRAM GOAL, EXAMPLE 1
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Program Goal: Promoting Software Technology within NASA
RBSE Team Member: _____

Objective (1): Develop Pilot Projects with NASA customers.

Possible Activities: Complete initial ROSE pilot and be included in the anticipated follow-on.

Establish the SATWG pilot.

Responsibilities: _____

Sample Measurement: Not quantifiable in general, but specific measures for the success of each pilot project should be developed.

Objective (2): Increase RBSE's "visibility" as a resource for NASA software developers.

Possible Activities: Define a role within the HPCC which gives RBSE major responsibility for distributing NASA-use-only software.

Work with groups of potential NASA clients (i.e. the SATWG and the STWG).

Become more involved with Code QE's "Experience Factory" effort.

Responsibilities: _____

Sample Measurement: Number of new users from NASA or NASA contractors.

Number of components used by NASA-affiliated software developers.

Objective (3): Tailor the repository operations to fit the needs of NASA customers.

Possible Activities: Develop an acquisition plan based on what is known about the needs of NASA customers.

Set up a NASA-use-only repository.

Responsibilities: _____

Sample Measurement: Number of software components acquired specifically for NASA customers

<p>The above is provided as a sample "worksheet" for each RBSE team member to think about the RBSE program goals, how they relate to specific activities, the team member's responsibility for these activities, and how to measure the success of these activities. Three sample objectives have been provided, with examples of activities for each; responsibilities have not been filled in. A sample measurement has been provided for each objective, but only as a suggestion. The RBSE team members should develop worksheets like this for all the program goals, and use them to define responsibilities and measurements.</p>
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<p align="center">WORKSHEET FOR RELATING OBJECTIVES AND ACTIVITIES TO A PROGRAM GOAL, EXAMPLE 2</p>
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Program Goal: Advancing Education and Awareness about Reuse
RBSE Team Member: _____

Objective (1): Expand the teaching of reuse as a technique of software engineering.

Possible Activities: Convince more universities to include reuse in their software engineering curriculum.
 Expand the current high school program.

Responsibilities: _____

Sample Measurement: Number of universities offering some courses that include the teaching of reuse as part of software engineering.

Objective (2): Increase awareness of RBSE among software professionals.

Possible Activities: Publish articles describing RBSE's experiences with one or more NASA pilot project.
 Attend major software conferences; give presentations about the RBSE program when possible.

Responsibilities: _____

Sample Measurement: Mentions of the RBSE program as an example of software reuse in professional software engineering journals.

<p>The above is provided as a sample "worksheet" for each RBSE team member to think about the RBSE program goals, how they relate to specific activities, the team member's responsibility for these activities, and how to measure the success of these activities. Two sample objectives have been provided, with examples of activities for each; responsibilities have not been filled in. A sample measurement has been provided for each objective, but only as a suggestion. The RBSE team members should develop worksheets like this for all the program goals, and use them to define responsibilities and measurements.</p>
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LIST OF RELATED DOCUMENTS

RBSE Concept Document, April 14, 1992.

White Paper, "The Repository -based Software Engineering Program: Redefining AdaNET as a Mainstream NASA Resource," February 9, 1993.

PMP Working Paper, "RBSE Goals and Objectives," August 1993.

RBSE Short-term Management Portfolio, June 26, 1992.

AdaNET Program Criteria, Discussion Draft for JSC, June 1991.

'92-'93 RBSE Research Plan, David Eichmann, August 28, 1992.

AdaNET Program Management Plan, February 13, 1991.

LIST OF ACRONYMS

AE	:	Applied Expertise, Inc.
ASSET	:	Asset Source for Software Engineering Technology
ASV3	:	AdaNET Service Version 3
CARDS	:	Central Archive for Reusable Defense Software
CCB	:	Configuration Control Board
CMR	:	Consolidated Management Report
CR	:	Change Request
DR	:	Discrepancy Report
HPCC	:	High Performance Computing and Communications Initiative
JSC	:	Johnson Space Center
MMR	:	Monthly Management Report
NASA	:	National Aeronautics and Space Administration
PMP	:	Program Management Plan
RBSE	:	Repository-based Software Engineering
RICIS	:	Research Institute for Computing and Information Systems
RIG	:	Reuse Library Interoperability Group
ROSE	:	Reusable Object Oriented Software Engineering
SATWG	:	Strategic Avionics Technology Working Group
STWG	:	Software Technology Working Group
UHCL	:	University of Houston at Clear Lake